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# HOUSE

## Housing Options for United States Employees

A Decision Support System  
for Assessing Costs

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## **Summary**

### **HOUSE: A DECISION SUPPORT SYSTEM FOR ASSESSING THE COST OF HOUSING OPTIONS FOR UNITED STATES EMPLOYEES**

The National Park Service (NPS) is examining the feasibility of Public-Private Ventures to provide new housing units for its employees. The Logistics Management Institute (LMI) prepared the Housing Options for United States Employees (HOUSE) model as an aid to help the NPS choose from among competing alternatives for new housing.

This version of HOUSE is adapted from an earlier edition used to assess Department of Defense housing proposals. The lack of housing allowances for NPS employees and the remoteness of many NPS sites required that LMI develop extensive new capabilities; with these modifications, HOUSE becomes an effective tool to assess the cost of any Government housing project.

The model calculates the cost to build and operate housing units over a period of up to 40 years and compares the relative costs of five major alternatives:

- Government-owned and -operated housing, either built to specification or using builder designs
- Housing built under a Government mortgage and operated by Government employees
- Housing built and operated on Government land by a contractor on a lease-purchase basis
- Housing built and operated on private land by a contractor on a lease basis
- Administrative or other revenue-generating facilities on private land for lease to the Government.

The model's detailed input capabilities allow the projects to be compared under a variety of conditions and assumptions, while ensuring the alternatives being compared will produce a facility of the same quality.

We recommend that the NPS Design Support Center adopt HOUSE as a tool with which to compare Public-Private Ventures with Government-financed housing

projects. We will make it available to any other Government agency for use as a framework to evaluate the relative costs of different approaches to meeting housing requirements.

# CONTENTS

	<u>Page</u>
Summary .....	iii
Chapter 1. Introduction and Overview .....	1-1
Defining a Scenario .....	1-1
Description of the Alternatives .....	1-2
What HOUSE Does .....	1-2
Standard Factors .....	1-3
Structure of the Documentation .....	1-3
Chapter 2. Model Inputs .....	2-1
Scenario Definition .....	2-1
Input Data Elements .....	2-3
Standard Factors .....	2-5
Explanation of the Operating Costs .....	2-6
Government Lease Reduction Options .....	2-7
Sensitivity Testing .....	2-8
Chapter 3. Construction Calculations .....	3-1
Infrastructure Improvement .....	3-1
Land Cost .....	3-1
Direct Cost of Construction .....	3-1
Total Construction Contract .....	3-3
Additional Costs to the Government .....	3-4
Total Cost of the Project .....	3-5
Financing Requirements .....	3-5
Chapter 4. Operating Cash Flow Calculations .....	4-1
Definition .....	4-1
Operating Costs .....	4-1
Rental Revenues .....	4-2
Secondary Income .....	4-3
Isolation Allowances .....	4-3
Annual Subsidies .....	4-4



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Dist		and/or	
A-1		Special	

## CONTENTS (Continued)

	<u>Page</u>
Chapter 5. Assigning Costs to the Alternatives .....	5-1
Cost Summary .....	5-1
Initial Costs .....	5-1
Annual Cash Flow .....	5-4
Assignment of Costs .....	5-5
Assignment of Cash Flows by Alternative .....	5-6
Chapter 6. Lease Payment and Total Cost Calculations .....	6-1
Lease Payments .....	6-1
Annual Cost to the Government .....	6-2
Chapter 7. Model Outputs .....	7-1
The HOUSE Summary Screen .....	7-1
Interpreting the Summary Screen .....	7-1
Using HOUSE for Decision Making .....	7-3
Appendix A. HOUSE User's Manual .....	A-1-A- 19
Appendix B. Input Data Elements .....	B-1-B- 8
Appendix C. Standard Factors .....	C-1-C- 6

## **CHAPTER 1**

### **INTRODUCTION AND OVERVIEW**

Housing Options for United States Employees (HOUSE) was developed by the Logistics Management Institute (LMI) to support the National Park Service (NPS) in deciding whether to pursue Public-Private Ventures (PPVs) as a means to provide housing for NPS employees. HOUSE makes simultaneous cost comparisons of several approaches to housing projects. It requires data readily available to the NPS park management at the site as well as industry-wide standard factors. Its accuracy is limited by those standard factors. HOUSE is intended not as a precise cost estimator, but rather to identify the most effective among competing approaches in development of a potential Request for Proposals (RFP).

To decide between competing approaches, NPS must consider several issues:

- How good should NPS housing be?
- How much money does NPS expect to have?
- How much rent should employees be expected to pay?
- How much will any given type of housing cost?

The first three issues are qualitative decisions to be made by NPS management; HOUSE can help solve the cost question. HOUSE calculates the probable cost to a contractor, the lease rent that will be required, and the total Government cost for each case. HOUSE then produces a summary output which allows side-by-side comparison of the costs for the approaches.

#### **DEFINING A SCENARIO**

The HOUSE scenarios have two components: The situation at the park where the projects would be installed and the alternatives that NPS management will consider.

The details at the site include basic information such as the number of housing units required for the project, their relationship to current housing units, occupancy

data, and local cost data. The specifics of these data are explained further in Chapter 2, Model Inputs. This information will change for each scenario.

## **DESCRIPTION OF THE ALTERNATIVES**

Five standard alternatives are considered by HOUSE. Not all may apply to each scenario, but the alternatives will all be analyzed the same way each time. The alternatives included are:

- Government-owned and -operated housing, either built to specification or using builder designs
- Housing built under a Government mortgage and operated by Government employees
- Housing built and operated on Government land by a contractor on a lease-purchase basis
- Housing built and operated on private land by a contractor on a lease basis
- Administrative or other revenue-generating facilities on private land for lease to the Government.

## **WHAT HOUSE DOES**

HOUSE reads the input data and uses them to calculate the estimated costs to build and operate housing units both on- and off-park in the proposed area. The HOUSE User's Manual is presented in Appendix A, and the specific cost elements used are shown in Appendices B and C. Those costs are then combined with the specific scenario defined – so many units to be built and managed in so many locations – to determine a cost to the builder and operator to provide the required services.

The costs of providing the service are then accumulated as costs to the Government or to the contractor. Many economic analysis models consider only the cost to the Government. HOUSE, however, must conduct a private-sector feasibility analysis. Part of the complexity of the HOUSE model derives from its need to keep track of two perspectives simultaneously: The contractor costs (to evaluate a fair lease payment for each alternative) and the Government costs (to provide a total-cost comparison between alternatives). HOUSE develops cash-flow projections for the contractor, calculates a lease payment sufficient to compensate the contractor for the

services, adds in the cost of any services performed by the Government directly, and determines a Government annual cash-flow projection over a 40-year period.

Those cash flows are converted to equivalent annual payments and net present value to the Government, and the alternative approaches are compared on that basis.

## **STANDARD FACTORS**

HOUSE uses standard factors as a visible way to present calculation assumptions rather than hiding them inside equations. HOUSE allows standard factors to be seen by a knowledgeable user but does not allow those factors to be modified. Users who need to make changes to the standard factors should contact LMI. The standard factors are listed in Appendix C.

## **STRUCTURE OF THE DOCUMENTATION**

The body of this report explains the purpose of the model, defines the assumptions and standard factors used to simplify the estimating process, shows how the standard factors and input data are combined in equations to produce the cost estimates, and explains how to interpret the summary output.

In Chapter 2, the inputs are defined. In Chapter 3, we explain the equations used to calculate the construction costs, and in Chapter 4, we provide the equations used to calculate the operations and maintenance costs. In Chapters 5 and 6, we demonstrate the combination of the cash flows into lease payments and total cost calculations, and in Chapter 7, we explain how to interpret the summary output.



## **CHAPTER 2**

### **MODEL INPUTS**

#### **SCENARIO DEFINITION**

The present version of HOUSE allows managers to consider three major methods of providing housing units, provides the alternatives of public- or private-sector construction of the units, and combines these possible approaches into several scenarios. Planners may ignore scenarios inappropriate for their needs.

The three methods for providing housing units are to build new units in new locations, to replace old units using the current sites, and to rehabilitate existing units. The replacement and rehabilitation will be on Government property, while the new units may be on Government or private property; in all three cases, the construction and later property management may be performed by Government employees (or contractors) or by private enterprises. In addition, the Government may ask that the contractor build and lease back certain other amenities (such as administrative or storage space).

HOUSE analyzes eight alternatives developed from these scenarios. In the appropriated fund alternative, the Government contracts directly for the construction of the houses on Government property, and then provides an employee or contract work force to operate and maintain them. The Government provides detailed specifications and performance requirements. Employee rents for all Government-owned or -leased hours are determined by Office of Management and Budget (OMB) Circular A-45.

A variation to the appropriated fund alternative, a "Turnkey" option, arises when a private builder is allowed to do most of the design and planning work, delivering a completed product for Government acceptance. This process reduces costs incurred through Government participation in the construction process. It would, however, require the Government to pay the builder in full upon delivery.

A second variant on the appropriated fund alternative recognizes one purpose for which the Government may enter the PPVs market: The lack of capital funds to

pay off the builder. In such a case, the Government might be able to pay for the buildings over time, as in a conventional mortgage transaction. The model cannot determine whether the Government will have to borrow the funds to pay for the capital improvements, but HOUSE can assign a cost to that possibility. HOUSE does not consider the Government's authority to enter into such a transaction.

A true lease, as opposed to a mortgage, requires some involvement on the part of the landlord. HOUSE considers three lease alternatives. In the first, a lease-purchase arrangement, a private company provides the needed units on Government land and operates and maintains the units for the duration of the lease. The units eventually become the property of the Government. To the extent that the Government desires to retain its existing assets, the Government continues to incur its cost of operating and maintaining its own housing on top of the lease payments.

Another alternative is a lease in which the private company builds and operates units off Government land, on the strength of a guaranteed lease period with the Government as the tenant. At the end of the lease, the owner retains the property to be released or to be used for any other purpose. HOUSE calls this alternative an off-park lease.

As another alternative, HOUSE considers the possibility that the Government may wish to lease additional units and retain its existing units but take advantage of possible efficiencies in the private sector by allowing a private firm to operate all the units in return for one overall lease payment. This concept is included in HOUSE's on-park lease alternative.

In another variation, HOUSE evaluates the effect of adding other revenue-producing activities (such as a collocated administrative facility) to the private-land alternative. HOUSE considers this variant separately: To have included this activity as an addition to each scenario would have doubled the number of scenarios in an already complex model.

Finally, HOUSE considers the opposite extreme: the free market case. In this alternative, the private sector builds the needed units outside the park and rents them directly to the employees. The Government performs needed renovations and building removals using its own funds. As a result, the constraints of OMB Circular A-45 disappear, and no controlled rent or isolation adjustments are needed. It is highly unlikely that housing can be built in remote areas for anything near the

rents in effect in the parks today, so under this scenario the difference will be made up out of the employees' pockets. This scenario is provided as a point of reference to evaluate the need for Government-subsidized housing programs.

## **INPUT DATA ELEMENTS**

HOUSE evaluates each of the eight scenarios described above using the specific Government requirements for the construction sites under consideration. Part of HOUSE's complexity arises from the need to define vague Government requirements. The 52 data elements required for adequate definition of a housing project are explained in detail in Appendix B; and the initial values contained in HOUSE (representing the Big Bend National Park scenario) are provided in Appendix A. We provide a simple listing here in order to portray the scope of the information that must be considered when evaluating a housing project. This information falls into four major categories: Housing Project Definition, General Environment, Local Environment, and Operating Costs.

- **Housing Project Definition**
  - ▶ **Location**
  - ▶ **Start year**
  - ▶ **Unit disposition (numbers):**
    - **Build new**
    - **Replace**
    - **Remove**
    - **Renovate**
  - ▶ **Occupancy**
  - ▶ **Public rentals**
  - ▶ **Season length**
  - ▶ **Housing offices**
  - ▶ **Nonhousing requirements**
  - ▶ **Capital replacement fund requirement**

- Construction type
  - Manufactured homes
  - Modular homes
  - Single-family homes
  - Garden apartments (townhouses)
  - Low-rise multifamily dwellings (flats)
  - High-rise apartments
- General Environment
  - Inflation
  - Discount rate
  - Capital cost
  - Loan period
  - Lease period
  - Davis-Bacon adjustment
  - Government (Denver Service Center) overhead rate
  - Children per unit
  - Appliances
- Local Environment
  - Impact Aid Regular-A Rate
  - HQ to gate distance
  - Distance to town
  - Town
  - Location factors
    - Labor
    - Materials
  - Minor construction budget
  - Maintenance and repair backlog

- Square footage requirements
- Land cost per unit
- Infrastructure and utilities
- Potential secondary income
- Number of units to be leased to private renters
- Commercial lease rates
- Operating Costs
  - Market rent
  - Management fee
  - Administrative staff payroll
  - Supplies
  - Utilities
  - Building services
  - Other operating expense
  - Security
  - Grounds maintenance
  - Maintenance
  - Painting and decorating, both interior and exterior
  - Property taxes
  - State and local taxes
  - Insurance
  - Recreation and amenities
  - Other payroll.

## **STANDARD FACTORS**

HOUSE uses standard factors to convert the input data into cost estimates. These factors are established by Government policy or are derived from historical experience: They do not change from one scenario to another. We will discuss the two

major standard factor tables, those addressing the construction and operating costs for the types of building recognized by HOUSE. Appendix C details the definitions of those standard factors, and several others that are in the HOUSE Standard Factors table.

## **EXPLANATION OF THE OPERATING COSTS**

HOUSE maintains two sets of operating costs: Those considered standard by industry and those experienced by the Government for the same types of services.

For the private-sector operating costs of multifamily structures, HOUSE uses data collected by the Institute of Real Estate Management (IREM). Private-sector costs for operating single-family buildings, whatever the construction type, are not well documented and were obtained by LMI from owners of small residential rental properties. Government costs for operating housing are more readily available through the Government budgeting and accounting systems, but in many cases these cost data may be under-reported or labor may be cross-charged. HOUSE uses the cost data available at the specific site, whenever possible. HOUSE users do have access to the industry and Government operating costs; because changes are usually not significant to the final results, we expect these tables to be treated as standard factors. The values of those operating costs, as distributed with the model, are shown in Table A-2 and Table A-3 of Appendix A. In order to be consistent, HOUSE uses the same cost elements for both private-sector and Government operating costs: where these costs have limited compatibility, the categories are used at the discretion of the analyst.

The Government tax and insurance lines are handled differently from those of the private sector. For the private sector, those costs are collected as an average of real experience based on a proportion of the rental income. Governments, however, pay no taxes, and tend to self-insure, so that there is no experience data. However, in looking at the services paid for by taxes, it is clear that most Government facilities enjoy similar services — security, fire protection, roads, etc. — and HOUSE assumes that a proportion of these costs will be allocated against the housing function at the site under consideration. HOUSE calculates the equivalent cost of self-insurance as prescribed in OMB Circular A-76: If the Government does in fact obtain true insurance, HOUSE would require a very minor programming adjustment to allow input data to override that calculation.

In addition to the costs, HOUSE has stored the IREM- or industry-reported rent levels for such properties. Those values can be replaced with the actual rents for comparable units in the project vicinity. IREM uses a rent-per-square-foot data system to avoid the issue of mixed residence sizes. HOUSE users should input a weighted average rent based on the composition of units in their proposed projects.

## GOVERNMENT LEASE REDUCTION OPTIONS

Several alternatives are available for the Government to reduce its annual lease payments or to make leases more favorable than in-house efforts. This happens when the Government takes on some portion of the initial capital cost or some portion of the risk. HOUSE applies these options by the method of "on" or "off" switches. The user can invoke them or not, as desired, but whether "on" or "off," these HOUSE options apply to all alternatives equally:

- *Assign a cost to Government land.* This option, required by OMB Circular A-104, eliminates one of the primary advantages of the in-house alternative, although in many cases the value of land in the NPS area can be quite insignificant.
- *Require the Government to pay utilities.* This option was developed for the military version of HOUSE, where on-base utilities are generally provided free of charge to the tenants. If the Government provides utilities to its tenants, HOUSE allows the same privilege to Government employees living in leased housing to avoid the creation of two classes of employees. The effect of this switch is to increase the annual cost to the Government (by assuming employee costs). It does not change the lease payment.
- *Allow the Government to provide the infrastructure.* HOUSE considers the possibility that the Government may elect to provide roads, sewers, electric hookups, etc., with one "switch," while another switch allows Government provision of foundations. This "provision" may be through in-house engineering or by appropriated fund contract. Such actions reduce the contractor's investment and therefore the size of the annual lease. The cost-effectiveness of these options depends on the relative efficiency of Government construction and the availability of first-year funds.
- *Require the Government to borrow its construction money.* This switch, considered to be appropriate by many in an era of heavy deficit spending, represents the Government's going into debt to obtain its "cash." The use of this switch erases a good portion of the major advantage of Government spending over private-sector construction, although the lending rate remains lower for the Government than for industry. HOUSE assumes that

annual payments themselves do not have to be borrowed, thereby lessening the impact of this switch.

- *Require employees to provide their own transportation* For the alternative in which new housing is constructed off the park, if the distance to the workplace exceeds 10 miles, HOUSE forces the contractor to provide a bus. That bus is expensive. Not requiring the bus places the transportation burden on the employees.

## **SENSITIVITY TESTING**

HOUSE is very well suited to sensitivity testing. The summary output (see Chapter 7) and the menu command structure combine to allow quick and easy testing of the different approaches to providing housing. The user needs only to enter the command menu in order to move quickly through the input data, make desired changes, and return to the summary sheets to see the effect; in fact, many changes can be invoked without even leaving the summary screen. Because the program is compiled before distribution, the user can only make changes in the construction program for a particular site: There is no possibility of tampering with the standard factors or calculations, thereby upsetting the fair comparison of the alternatives.



## **CHAPTER 3**

### **CONSTRUCTION CALCULATIONS**

In this chapter, we explain how HOUSE calculates the cost of constructing housing units. The construction module addresses only three basic approaches: units are constructed by the Government, units are constructed by private builders on Government land, or units are constructed by private builders on private land. The costs of these three approaches are calculated in parallel based on the project description provided as part of the data input process.

#### **INFRASTRUCTURE IMPROVEMENT**

As described in Chapter 2, there may be costs for horizontal construction and utility runs greater than those normally required for a housing project in the private sector. Those costs are provided in the input process. HOUSE sums them.

#### **LAND COST**

Land cost = Cost per unit  $\times$  number of units built.

Additionally, the land cost is multiplied by the Government land cost switch (set to zero if that cost is not to be counted). For on-park construction, the number of units built includes only the new units. For the off-park alternatives, the number built includes those built as replacement units.

#### **DIRECT COST OF CONSTRUCTION**

HOUSE computes the direct construction cost (the "sticks and bricks" cost) based on the square footage to be built.

Direct cost = Technical construction cost  
+ Davis-Bacon adjustment  
+ Site preparation and support  
+ Materials transport  
+ Rehabilitation requirements  
+ Building removals  
+ Appliances and furnishings.

These elements of cost are calculated as follows:

- Labor = Per-square-foot construction labor cost  
× local labor cost factor  
× (units to be built new plus units to replace)  
× square-foot size of unit  
× inflation.

Inflation is computed using the input inflation value to raise the cost data from current- (data collection) year values to project-year values. Thus, construction data collected in 1988 must be inflated to 1991 then-year dollars. HOUSE's feasibility calculations are based on project-year dollars.

The per-square-foot construction costs of administrative and other additional facilities are assumed to be the same as the costs to construct modular housing units.

- Materials = Per-square-foot construction materials cost  
× local materials cost factor  
× (units to be built plus units to replace)  
× square-foot size of unit  
× inflation.
- Technical construction cost = Labor plus materials.
- Davis-Bacon adjustment = Labor cost  
× Davis-Bacon rate  
× Davis-Bacon applicability.
- Site preparation and support = Site preparation and support factor  
× (5-foot line cost plus Davis-Bacon adjustment)  
× (units to be built new divided by total units),

where total units = units to be built  
+ units to be replaced.

- Materials transport = Per-unit transport cost  
× (number to build plus number to replace)  
× inflation.

- Rehabilitation requirements: This calculation is based on the idea that rehabilitation can be expressed in terms of a proportion of the cost to build new units. HOUSE uses the formula:

$$\begin{aligned} \text{Rehabilitation cost} = & (\text{5-foot line cost plus Davis-Bacon adjustment} \\ & \text{plus site preparation plus materials} \\ & \text{transport}) \\ & \times \text{renovation cost factor} \\ & \times \text{renovation number}/(\text{number to build plus} \\ & \text{number to replace}). \end{aligned}$$

- Building removals = Per-modular-unit transport cost  
 $\times$  inflation  
 $\times$  number of units to remove.
- Appliances and furnishings = Appliance suite cost  
 $\times$  (number of units to build plus number to replace).

#### TOTAL CONSTRUCTION CONTRACT

- Total construction contract = Total direct cost  
 $+ \text{overhead}$   
 $+ \text{passthroughs}$   
 $+ \text{profit}$   
 $+ \text{land cost (except for Government in-house)}.$
- Overhead = Overhead rate factor  
 $\times \text{total direct cost less furnishings and appliances}.$
- Passthroughs: Industry standard costs contained in *Means*<sup>1</sup> include all subcontractor costs. Thus, HOUSE's passthrough costs are zero.
- Profit = Construction profit factor  
 $\times (\text{total direct cost plus overhead plus passthroughs}).$

Profit is charged to the Government in-house alternative because the work is actually done under contract and that builder will require a profit.

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<sup>1</sup>R. S. Means Company, Inc. *Means Square Foot Costs 1988*. Kingston, Mass.: R. S. Means, 1988.

## ADDITIONAL COSTS TO THE GOVERNMENT

- Additional costs = Plan and design  
+ contingency fund  
+ builder's site inspection and overhead (SIOH)  
+ Government SIOH  
+ delay cost.
- Plan and design = Planning and design factor  
× total direct cost.

The Government in-house option contains no extra plan and design fee because that work is done by Government SIOH activities.

- Contingency funds = Contingency factor  
× total direct costs.

The Government rate is increased by 1.5 percent over the private rate to reflect prevailing practices.

- Builder's SIOH = Total direct cost  
× (private sector SIOH factor plus Government oversight factor).

Two SIOH factors are used for the private-sector on-park construction alternative because of the need to comply with the usual state and local requirements plus interface with Government contracting activities.

- Government SIOH = Total direct cost  
× Government SIOH factor, for in-house alternatives, or Government oversight factor for privatized alternatives.
- The Government SIOH factor is the Government [in this case, Denver Service Center (DCS)] overhead rate less contingency, planning, and design. As contained in the distributed model, that factor is:

DSC rate	=	46%
Planning and design	=	10%
Contingency	=	<u>10%</u>
Government SIOH	=	26%

- Delay cost = Extra renovation cost  
+ employee attrition cost

where

$$\text{Extra renovation cost} = \text{Delay time} \times \text{current annual maintenance expense}$$

and

$$\begin{aligned} \text{Employee attrition cost} = & \text{Employee average salary} \\ & \times \text{delay time} \\ & \times \text{current work force strength} \\ & \times \text{percent attriting.} \end{aligned}$$

## TOTAL COST OF THE PROJECT

The total cost is the total construction contract plus the additional costs to the Government.

## FINANCING REQUIREMENTS

Calculation of the annual lease payments or equivalent payments requires consideration of certain other factors which are based on the total cost of the project.

- Financing fees: The Government pays no financing fees. For the private builder,

$$\begin{aligned} \text{Fees} = & (\text{Number of units to build plus number to replace}) \\ & \times \text{development fee factor} \\ & + (\text{financing fee factor multiplied by the amount financed}), \end{aligned}$$

where

$$\begin{aligned} \text{Amount financed} = & \text{Total direct cost} \\ & \times \text{financing limit factor.} \end{aligned}$$

- Cash requirement = Total cost of project  
+ financing fees  
- amount financed.
- Loan service is calculated through an amortization function using the amount financed, the loan period, and the capital borrowing cost. The Government will be assessed interest if that "switch" was selected during the input session.
- Required return on cash investment: The money invested by the builder in cash down-payments must be included in interest and return calculations.

HOUSE assumes that the builder's opportunity cost is the commercial lending rate. In the first year, this return is:

$$\begin{aligned} \text{Required return} &= \text{Cash requirement} \\ &\times \text{cost of borrowing capital.} \end{aligned}$$

Government in-house construction projects are paid for in cash but require no return on investment.

- Terminal value: The value of the property at the end of the lease is calculated using the procedures prescribed in OMB Circular A-104.

$$\begin{aligned} \text{Capital deterioration} &= (\text{Total construction contract inflated by the} \\ &\text{inflation rate less 1.7 percent}). \end{aligned}$$

$$\begin{aligned} \text{Real estate appreciation} &= (\text{Land cost inflated by the inflation rate} \\ &\text{plus 1.5 percent}). \end{aligned}$$

Terminal value is taken as the sum of the capital deterioration plus the real estate appreciation. This conservative approach understates the effect of equity appreciation in some markets but may be adequate for NPS calculations.

- Depreciation tax writeoff: For private builders on or off Government land,

$$\begin{aligned} \text{Writeoff} &= (\text{Total construction contract minus land cost}) \\ &\div \text{by depreciation life-cycle factor} \\ &\times \text{tax bracket factor.} \end{aligned}$$

- Capital replacement fund: There is no such requirement for the Government. Private builders on- and off-park use:

$$\begin{aligned} \text{Fund} &= \text{Total construction contract} \\ &\times \text{capital replacement fund requirement.} \end{aligned}$$

These calculated values will be used in the formulae described in the following chapters.

## CHAPTER 4

### OPERATING CASH FLOW CALCULATIONS

#### DEFINITION

Operating cash flow consists of operating costs and rental revenues.

#### OPERATING COSTS

The operating costs are calculated for the selected type of building using the per-square-foot costs entered in the data input phase. The operating cost calculations compress the categories of data explained in Chapter 2, but the general formula remains the same:

$$\begin{aligned} \text{Element of operating cost} &= \text{Operating cost factor} \\ &\quad \times \text{units managed} \\ &\quad \times \text{inflation,} \end{aligned}$$

where

$$\begin{aligned} \text{Units managed} &= \text{Number to build} \\ &\quad + \text{number to replace} \\ &\quad + \text{number to renovate.} \end{aligned}$$

As noted in Chapter 2, military insurance is calculated as prescribed by OMB Circular A-76, where

$$\begin{aligned} \text{Insurance} &= 0.005 \\ &\quad \times \text{total direct cost.} \end{aligned}$$

Private-sector operations and maintenance contract profit is calculated as follows:

$$\begin{aligned}\text{Overhead and profit} = & \text{Operating profit factor} \\ & \times (\text{management salaries and fees} \\ & \quad \text{plus administrative staff payroll} \\ & \quad \text{plus supplies} \\ & \quad \text{plus building services} \\ & \quad \text{plus security} \\ & \quad \text{plus grounds maintenance} \\ & \quad \text{plus insurance}),\end{aligned}$$

or in other words, overhead and profit on taxes and utilities are not permitted.

Before being added as a cost, the expenses of operating recreational facilities and performing grounds maintenance are compared to the potential revenue. If these services cost more than the expected revenue, they will not be provided, and no cost is assigned.

Park Employee Bus Service is added to the operating costs for the off-park alternative unless the "no bus" cost reduction switch has been selected.

## RENTAL REVENUES

Rental revenues are derived from four basic sources: family houses, permanent-status single employee apartments, seasonal single employee dormitories, and rentals to the public.

HOUSE is not sufficiently detailed to capture a mix of two-, three-, and four-bedroom unit rental rates. It uses the average rental rate provided in the input process. For families,

$$\begin{aligned}\text{Rent receipts} = & \text{Family rents} \\ & + \text{permanent single rents} \\ & + \text{second single rents} \\ & + \text{secondary income.}\end{aligned}$$

$$\begin{aligned}\text{Family rent} = & \text{Market rent per month} \\ & \times (\{\text{permanent families} \times 12\} \text{ plus } \{\text{seasonal families} \times \text{length} \\ & \quad \text{of season}\}).\end{aligned}$$



Rent for permanent status single employees is set at one-half the per-family rent, so that permanent single rent = market rent per month  $\times$  number of permanent single employees  $\times$  12.

Rent for seasonal single employees is based on an NPS-wide *daily rent rate*.

Seasonal single rent = Daily rent factor  
 $\times$  365 days/year  
 $\times$  number of months in season  
 $\div$  by 12 months per year  
 $\times$  number of seasonal single employees.

Public rent receipts = Market rent  
 $\times$  number of public rental units  
 $\times$  0.75 occupancy factor.

## SECONDARY INCOME

Potential secondary income = Monthly secondary income factor  
 $\times$  (number to build plus number to replace  
plus number to renovate plus number  
of public rental units)  
 $\times$  12 months per year.

The secondary income factors differ for on- and off-park alternatives because of the greater freedom to develop secondary income off-park. However, if the cost of operating the revenue-generating facilities exceeds the potential revenue, there will be no rental revenue because those facilities will not be provided. For the alternatives with administrative structures, a fixed rent (dollars per square foot per year) is added to the secondary income.

## ISOLATION ALLOWANCES

The isolation allowances are calculated for three categories of tenants: families, apartment tenants, and dormitory tenants. This is done because of the proviso that the isolation adjustment cannot exceed 45 percent of the unadjusted rent.

Adjustment = Number of tenants in group  
 $\times$  *Minimum of:*  
Distance to town  
 $\times$  2 (round trip)                      or                      Market rent  
 $\times$  4 trips per month                       $\times$  0.45.  
 $\times$  mileage rate factor

## ANNUAL SUBSIDIES

Under certain circumstances, local Governments and other agencies of the Federal Government may agree to provide subsidies to Government housing projects, usually through some form of tax relief. HOUSE provides a place for direct entry of the value of these subsidies (cells G122 to M123) if appropriate. The model is delivered with these values set to zero.

School impact aid parameters are provided through the data input process described in Chapter 2. Where it applies, the calculation is:

$$\begin{aligned}\text{Impact aid} &= \text{Units managed} \\ &\quad \times \text{children per housing unit factor} \\ &\quad \times (\text{Regular-A Aid level minus Regular-B Aid level}).\end{aligned}$$

Impact Aid applies only to housing units built on Government land. The A minus B calculation is used because if Impact Aid is required, all children of Federal employees will count toward a calculation of Impact Aid or at least the B level, whether their residence is on Federal land or not; thus, only the difference should be considered for comparative purposes.

## CHAPTER 5

### ASSIGNING COSTS TO THE ALTERNATIVES

#### COST SUMMARY

The costs and revenues described in the preceding chapters are compressed into a Cost Summary, as shown in Table 5-1. There is a separate Cost Summary for Government construction, private construction on Government land, and private construction on private land. The summary has four components: initial costs, annual costs, revenues, and terminal value. This summary collapses the detailed calculations explained in Chapter 4 into broader categories. Each category is then given a code to be used for cross-reference in Table 5-2. The point of Table 5-1 is that it identified a cost of each essential element in the construction and maintenance life cycle, and that cost may differ depending on whether the service is provided by the private sector or by Government. PPV alternatives can then be modeled simply by drawing together the appropriate costs from each column. Thus, in Table 5-2, the appropriated fund alternative contains all "G" codes, while the turnkey alternative shows "L" codes for the construction phase.

#### INITIAL COSTS

Initial costs include plan and design, site work, construction, rehabilitation, appliances and furnishings, and cash deposits. These cost elements are not totaled, they are simply collected in one place to facilitate assignment to the various alternatives.

Those costs regroup and compress the costs calculated in earlier chapters, as follows:

Plan and design = Builder plan and design costs  
                  + builder SIOH  
                  + Government SIOH  
                  + fees.

**TABLE 5-1**  
**COST ELEMENTS BY SERVICE PROVIDER**

Element	Provided by			
	Government	Private sector on park	Private sector off park	Administrative center off park
<b>Initial costs</b>	G10	L10	P10	A10
Plan and design	G11	L11	P11	A11
Site work	G12	L12	P12	A12
Construction	G13	L13	P13	A13
Rehabilitation	G14	L14	P14	A14
Appliances and furnishings	G15	L15	P15	A15
Cash deposits	G16	L16	P16	A16
<b>Annual costs</b>	G20	L20	P20	A20
Operating costs	G21	L21	P21	A21
Utilities	G22	L22	P22	A22
Capital replacement	G23*	L23	P23	A23
Debt service	G24	L24	P24	A24
<b>Revenues</b>	G30	L30	P30	A30
Rent	G31	L31	P31	A31
Secondary	G32	L32	P32	A32
Isolation adjustment	G33	L33	P33	A33
<b>Terminal value</b>	G40	L40	P40	A40
Contractor	G41 = 0	L41 = 0	P41	A41
Government	G42	L42	P42	A42 = 0
<b>Subsidies</b>				
To contractor	G51	L51	P51	A-51
From Federal	G52	L52	P52	A-52

\* The Government incurs no capital replacement fund costs. However, if the annual construction budget for the site is inadequate when compared to the maintenance backlog, the Government will be required to conduct an extensive renovation in year 30.

TABLE 5-2

## ASSIGNMENT OF COSTS TO PROVIDER BY ALTERNATIVE

Cost element	Alternatives							
	Appropriated fund	Turnkey	Mortgage	Lease on-park	Split location lease	Off-park lease; on-park NPS	Off-park lease with administrative centers; on-park NPS	NPS on-park; direct lease to employees off-park
Initial costs								
Plan and design	G11	L11	L11	L11	P11	P11	P11 and A11	P11
Site work	G12	L12	L12	L12	P12	P12	P12 and A12	P12
Construction	G13	L13	L13	L13	P13	P13	P13 and A13	P13
Rehabilitation	G14	L14	L14	L14	L14	G14	G14	G14
Appliances and furnishings	G15	L15	L15	L15	P15	P15	P15 and A15	P15
Cash deposits	0	L16	L16	L16	L16 (Note 1)	P16	P16 and A16	P16
Annual cash flow								
Contractor	0	0	0	L21 and Note 2	L21 and Note 2	P21 and Note 2	P21 and Note 2 and A21	P21 and Note 2
Operating	0	0	0	L22	L22 and Note 2	P22	P22 and A22	P22
Utilities	0	0	0	Note 3	Note 3	Note 3	Note 3	Note 3
Capital replacement	0	0	0	Note 4	Note 4	Note 4	Note 4	Note 4
Debt service	0	0	Note 4	L51	Note 2	0	A31	Note 5
Subsidies	0	0	G51	0	Note 6	P32	P32 and A32	P32
Rent	0	0	0	0	0	0	0	0
Secondary income	0	0	0	L32	Note 6	P32	P32 and A32	P32
Government								
Operating	G21	G21	G21	0	0	G21 x Note 7	G21 x Note 7	G21 x Note 7
Utilities	G22	G22	G22	0	0	G22 x Note 7	G22 x Note 7	G22 x Note 7
Subsidies	G52	G52	G52	L52	P52 + Note 7	P52 + Note 7	P21 and A21 + Note 7	P52 + Note 7
Debt service	0	0	0	0	0	0	0	0
Rent	G31	G31	G31	L31	Note 5	Note 5	Note 5	Note 5
Secondary income	G32	G32	G32	0	0	G32 x Note 7	G32 x Note 7	G32 x Note 7
Isolation	G33	G33	G33	G33	G33	G33	G33	Note 8
Terminal value								
Contractor	G41	G41	G41	L41	P41	P41	P41 and A41	P41
Government	G42	G42	G42	L42	Note 9	Note 9	Note 9	Note 9

Note: The cost elements are those listed in Table 5-1 and the notes appear on pages 5-5 and 5-6.

Note that, even for appropriated fund construction the builder incurs the normal commercial SIOH costs as he ensures his work will be acceptable to the Government. Government inspection costs are then incurred over and above the builder's costs.

- Site work: single item
- Construction = Infrastructure improvement  
+ contingency  
+ total construction contract  
- site preparation  
- rehabilitation requirements  
- appliances and furnishings.
- Rehabilitation: single item
- Appliances and furnishings: single item
- Cash deposits: single item.

#### **ANNUAL CASH FLOW**

Annual costs consist of operating costs (less utilities), utilities, the capital replacement fund, debt service, and isolation adjustments.

- Operating costs (less utilities) sum all the operating costs discussed in Chapter 4, removing the utility costs.
- Utilities are unchanged from the values calculated as explained in Chapter 4.
- The capital replacement fund is calculated by:

Total direct construction percentage (explained in Chapter 4)  
× capital replacement percentage (specified in the input data).

- Debt service is the annual payment of interest and principal on the capital borrowed. That cost includes the return on investment of the contractor's cash deposits, as described in Chapter 4.

Debt service = Loan service  
+ return on investment.

- Isolation adjustments are unchanged from the values calculated as explained in Chapter 4.

Revenues include rent income and secondary income, while terminal value identifies the value to the owner of the capital improvements at the end of 40 years.

## ASSIGNMENT OF COSTS

For each of the alternatives considered, different factors are responsible for different costs. Table 5-2 depicts graphically the determination of each party's contribution to the alternatives. The matrix shows the cost elements just described, with one embellishment: The annual costs are accounted for separately between contractor and Government. These cost elements are then assigned to each of the alternatives. The party which will bear that portion of the cost is identified by the codes shown in Table 5-1. In some cases, these costs are shared: The following notes explain those situations. (References to these notes appear in Table 5-2.)

1. The split-location alternative uses the cash-deposit value from the on-park lease (L16); otherwise, it would be necessary to recalculate the entire construction cost.
2. For the lease alternatives, the operating costs (less utilities) are increased by multiplying the salaries by the number of sites to be served. This represents the requirement to meet minimum staffing levels at each location. For the split-location alternative only, the basic operating costs, utility costs, and subsidies are calculated as:

$$\begin{aligned}\text{Cost} &= \text{Private on-park costs} \\ &\quad \times \text{number of renovated units/total number of units} \\ &\quad + \text{private off-park costs.}\end{aligned}$$

3. The capital replacement fund costs for all privately operated projects is the construction cost (L13 or P13) multiplied by the replacement fund level specified in the input process.
4. For all the privately managed alternatives, the debt service is the payment required to amortize a principal of all the construction costs (L11 through L14 or P11 through P14). Government-operated projects are assumed to have capital replacement included in the operating costs (see, however, the note on Table 5-1).
5. The rent received from tenants is assumed to be the same, per unit, under all alternatives (i.e., the average rent is used). In the direct rent to employees alternative, the rents from the off-park unit are received by the contractor; otherwise, all rents are income to the Government.
6. The secondary income for the split location alternative is calculated using the private on-park rate for on-park units and the private off-park rate for off-park units.

7. In the off-park alternatives, the Government must continue to maintain its existing nonremoved units. That cost is assessed for operations, utilities, and subsidies as:

$$\begin{aligned}\text{Cost} &= \text{Government cost} \\ &\times \text{number of renovated units} \\ &\div \text{by total units.}\end{aligned}$$

8. In the rent direct to employees alternative, the Government pays isolation adjustments only to those employees living on the park (renting directly from the Government).
9. The alternatives in which units are located both on and off the park require that terminal values be shared. The contractor gets the terminal value for the off-park property (P41), but the Government terminal value is:

$$\begin{aligned}\text{Terminal value} &= \text{Terminal value for all Government units (G42)} \\ &\times \text{number of renovated units} \\ &\div \text{by the total number of units.}\end{aligned}$$

#### **ASSIGNMENT OF CASH FLOWS BY ALTERNATIVE**

Table 5-3 shows how HOUSE summarizes the numerous cost elements above into a consistent formula for initial and annual costs for each alternative. The table helps to highlight some of the key differences between the alternatives, the major one being the incidence of the capital costs.

These cash flow allocations will differ as the "Government lease payment reduction switches" are used. For instance, if the Government chooses to provide building foundations, that cost would be included in the Government's "initial" costs and be removed from the contractor's capital requirements. The possible combinations are too numerous to attempt to portray here.



TABLE 5-3

## ASSIGNMENT OF INITIAL AND ANNUAL COSTS BY ALTERNATIVE

Alternative	Contractor		Government	
	Initial	Annual	Initial	Annual
Government <sup>1</sup>	None	None	All	All
Turnkey <sup>1</sup>	None	None	All	All
Mortgage <sup>1</sup>	Cash deposits	Debt service	None	Annual lease + Government annual costs + isolation - rent receipts - secondary income
On-park lease, and split- location lease	Cash deposits	Debt service + contractor annual costs - contractor annual income	None	Annual lease + Government annual costs - Government annual revenues
Off-park leases, on- park NPS <sup>1</sup>	Cash deposits	Debt service + contractor annual costs - contractor annual revenues	Rehabilitation	Annual lease + Government annual costs - Government annual revenues

<sup>1</sup> These alternatives are subject to a renovation cost at the 30-year point if the Government devotes inadequate funding to routine maintenance.

## **CHAPTER 6**

### **LEASE PAYMENT AND TOTAL COST CALCULATIONS**

The annual cost borne by the Government for any of the alternatives is the sum of the lease payments to the contractor and the costs incurred by the Government for any work not done by the contractor.

#### **LEASE PAYMENTS**

The lease payments are calculated using the annual cash flow estimates developed for each of the alternatives, as described in Chapter 5. The cash flows included when calculating the lease payment are only those which affect the contractor. HOUSE maintains the cash flows in constant project-year dollars; in addition to reducing the complexity of the model's formulae, the constant-dollar treatment allows easier identification of changes in the cash flows.

For each alternative, the lease payment is that payment which will, over the same period, return to the contractor all the expenses incurred, plus an acceptable margin (carrying cost). The cash flows are converted to a single principal value by a Net Present Value (NPV) calculation which discounts the cash flows over 39 years (there will be no lease payment until the facilities are delivered). The required lease payment is then determined by annualizing that NPV. The discount figure used for the contractor is the Government discount rate, because HOUSE assumes that the contractor will not be able to make investments at the same rate he is charged for construction funds. The lease payment calculation is the same for each alternative, so further discussion of the lease payments is confined to the annual cash flows.

For the Government in-house and the turnkey alternatives, there are no lease payments because all contracted construction costs are paid in full through appropriated funds.

The mortgage alternative requires the contractor to pay the large initial cash down-payments in year 0 and make annual debt service payments for the duration of the loan period.

The on-park alternative requires the same initial down-payments in year 0. In subsequent years, the contractor is responsible for all operating costs (lines 253 to 256); however, debt service payments drop to 0 at the end of the loan period. The contractor receives an annual revenue from secondary income. There is no terminal value to the contractor.

The same cash flow structure is seen for the on- and off-park alternatives, the off-park only alternative, and the off-park with administrative space alternative, although the values are somewhat different, as described in Chapter 5. In these cases, however, there is a terminal value to the contractor; that value, being calculated in present value terms as explained in Chapter 3, is simply subtracted from the NPV of the cash flows.

After the contractor's required lease payment is determined, HOUSE displays the annual lease in terms of rent per unit per month. Note that the services that this rent buys differ from one alternative to another. For the mortgage, this rent reflects only the capital cost of placing the units in service. For the on-park and split-location alternatives, this rent covers the full housing cost.

For the off-park alternatives, the equivalent per-unit rent covers full service on only the off-park units (new units plus replacement units). The off-park rents per unit are higher because there is no relatively inexpensive renovation work subsidizing the construction cost for new units. For the alternative with an administrative center, the gross lease is reduced by the value of the administrative center lease before calculating the per-unit rent. The direct rent to employees alternative has no gross annual rent. The rent is calculated in one step on a per-unit basis for the off-park units.

## **ANNUAL COST TO THE GOVERNMENT**

The net costs to the Government are computed in much the same way as for the contractor, except that different costs are used to develop the cash flows.

For the Government in-house alternative and the turnkey alternative, the Government bears all initial costs in year 0. In subsequent years, the Government bears all the operating costs, but receives annual revenues. The annual revenues are the sum of the rents and the secondary income, less the isolation adjustment. Note that in all alternatives except the direct rental to the employee, the isolation

adjustment cost must be borne by the Government. After the NPV is calculated, the NPV cost is decreased by the terminal value of the property to the Government.

In the mortgage alternative, the Government must additionally pay the lease payment to the contractor (the "mortgage") every year. Because the payment has been amortized over the full 40 years of the lease (in the determination of the appropriate lease payment), this payment continues past the point that the contractor's own loan has been paid off.

For the lease alternatives, there is no initial cost to the Government, and there is no lease payment in year 0. The rents and isolation adjustments incurred in year 0 are ignored because they represent a continuance of the status quo. For the off-park options, however, the Government does incur the cost of on-park rehabilitation in year 0.

The on-park lease alternative and the split-location alternative are full-service leases. Therefore, the alternatives require only that the Government pay the lease and collect the rents less isolation adjustment. At the end, the Government realizes terminal value although the basis is reduced in the split-location alternative because the contractor retains the off-park property.

In the off-park alternatives, the Government retains the responsibility to operate the on-park housing. Thus, its costs are:

- Lease payment for off-park housing (and administrative space)
  - + Operating costs of on-park housing
  - Rents received from tenants less isolation adjustment,

where operating cost of on-park housing are

- Cost = Sum of total in-house operating costs  
× (number of units renovated divided by total units).

At the end of 40 years, the Government derives terminal value for on-park units. The direct rent to employees alternative is different from the above in that the lease is not paid by the Government, and the only rents received from the employees are those for on-park units.

After the Government cash flows are identified, HOUSE calculates an NPV in absolute cost for each alternative. HOUSE then computes an equivalent annual cost for each alternative (simply an annualization of the NPV); and by comparing the

equivalent annual cost to the Government in-house alternative, an effective subsidy is calculated.

## CHAPTER 7

### MODEL OUTPUTS

#### THE HOUSE SUMMARY SCREEN

HOUSE's primary output is the summary screen, shown in Figure 7-1. This summary can be printed by the HOUSE user. (See the User's Manual in Appendix A.)

Option	NPV (\$ millions)	Net annual cost (\$ thousands)	Annual lease (\$ thousands)	Annual subsidy (\$ thousands)
Government	4.6	268	0	N/A
Turnkey	4.1	239	0	(29)
Mortgage	6.4	371	286	103
On-park	4.6	270	498	1
Split location	6.8	395	581	127
Off-park only	6.3	368	426	100
Off-park, with administrative space	6.5	378	436	109
Direct rent to employee	1.0	59	0	(209)
Unit rent	\$701 per month			
Rent is 40 percent of employee average gross income: current rent is 11 percent.				
<div>Big Bend, TX</div> <div>1 Management Office</div> <div>93 Manufactured Houses</div>				

FIG. 7-1. HOUSE SUMMARY SCREEN – COST COMPARISONS

#### INTERPRETING THE SUMMARY SCREEN

The summary screen shows the eight alternatives for which HOUSE makes cost estimates. Each estimate is provided in terms of an NPV in millions of dollars.

Additionally, the net annual cost, the annual lease, and the annual subsidy are shown in thousands of dollars per year.

NPV is the best basis on which to compare the alternatives. It represents the amount of money one would have to have on hand today to completely pay for the project under the selected alternative. The net annual cost is another method of expressing the same relationship, in terms of the number of dollars that would have to be set aside each year to pay for the project. Neither of these alternatives addresses the very fundamental issue of whether the entry fee into the project is affordable.

The annual lease is the actual amount of the payment that would have to be provided to the contractor to operate housing as envisioned by the alternative. Note, for instance, that the Government alternative requires no lease payment; the net annual cost figure, often less than the other annual costs, reminds us that although the initial cash investment required to pursue appropriated fund construction may be unaffordable, an alternative with an affordable lease payment may be more expensive in the long run.

The annual subsidy is the amount the NPS would pay each year over the annualized cost of building the housing through the traditional Government process. It is, in essence, the annual finance charge for stretching the payments out. In some scenarios, this is a negative number; that is, net savings are generated.

The summary also shows the payment which would be required of employees, as a dollar figure and as a percentage of income, if they were to rent under the direct rent alternative. That is necessary because the costs to the Government for that alternative are limited to maintaining selected on-park units. Such an alternative may appear extremely attractive if the employee perspective is ignored.

In addition, the summary screen portrays the name of the park, the type of building being considered, and the "on or off" positions of the "switches" that may be used by the Government to reduce its lease payment (see Figure 7-2). These items of information are necessary to document the model run from which the data were taken and the assumptions that were made. This documentation is limited in that numerous items of data can be altered without any indication on the summary

screen: For complete documentation, HOUSE prints the data input values when the summary table print command is selected.

Switch settings (1 = yes)			
Government land costs	0	Government foundations	0
Government pays utilities	0	Government has to borrow	0
Government infrastructure	0	No employee bus	0

FIG. 7-2. SUMMARY SCREEN – PROJECT DOCUMENTATION

## USING HOUSE FOR DECISION MAKING

The summary screen provides a fairly complete assessment of the selected scenario. Decision makers can perform several analyses very quickly by changing the building types, resetting option switches, or reviewing critical data input elements. HOUSE cannot be allowed to make the decision: There are great gaps in qualitative and mission-impact terms between relatively similar scenarios that cannot be considered in terms of simple cost. HOUSE presents the alternatives in terms of cost to the Government: The decision maker must decide what the tradeoffs are worth.



**APPENDIX A**

**HOUSE USER'S MANUAL**

## CONTENTS

	<u>Page</u>
1. Introduction .....	A- 3
2. Hardware and Software Requirements .....	A- 3
3. Getting Started .....	A- 4
4. Running the Model .....	A- 7
5. Assumptions .....	A- 8
6. Making Changes within Cells .....	A-13
7. Scenario Summary .....	A-14
8. Printing the Results .....	A-15

# **HOUSE USER'S MANUAL**

## **1. INTRODUCTION**

This abbreviated user's manual is intended to assist the user in loading the model into a computer, entering site-specific data, accessing the summary, and printing scenario documentation. Interpretation of the data requirements and scenario summary is described in the main text of this report and is not repeated here.

### **Software Package**

HOUSE has been compiled from a Lotus 1-2-3™ spreadsheet model. Compilation accomplishes two goals. First, it makes the model smaller, requiring less active memory, and therefore faster. Second, it prevents inexperienced users from making inadvertent changes to the model. In a complex model such as HOUSE, a small change in the spreadsheet is extremely difficult to detect but may have significant effects on the calculations. Through compilation, the user is denied access to the formulas, thereby preventing such mishaps. The original source code is retained at the Logistics Management Institute (LMI) and minor changes, for example, to standard factors can be accomplished very quickly.

To conform with the usual configuration of Federal personal computers (PCs), HOUSE is distributed on diskettes of 360 kilobytes (Kb) capacity. Disk 1, the Data diskette, contains the model and the data for the site under consideration. Disk 2, the Runtime diskette, contains several files used by the compiled program that emulates (has the "look and feel" of) Lotus 1-2-3 on the user's computer.

## **2. HARDWARE AND SOFTWARE REQUIREMENTS**

### **Hardware**

HOUSE requires an IBM PC™ or compatible computer with a minimum of 512 Kb of Random Access Memory (RAM). The computer must have either a hard disk or two floppy disk drives, one of which must be high-density [1.2 megabytes

(Mb)]. If the computer has a hard disk drive, the floppy disk drive may be either high-density or low-density (360 Kb).

## **Software**

The user must have MS-DOS™ version 2.0 or higher to run HOUSE. The compiled HOUSE emulates (has the "look and feel" of) the Lotus 1-2-3 spreadsheet from which it was compiled and responds to most Lotus commands. Therefore, although no extensive PC experience is needed simply to run HOUSE, a basic understanding of Lotus 1-2-3 is recommended for a more insightful use of the model.

### **3. GETTING STARTED**

#### **Instruction Conventions**

Instructions will be given for users running HOUSE from a hard drive and from a 1.2 Mb floppy diskette. The instructions will be identified for each system where they differ. In order not to repeat the system definitions at each point, we will use the following conventions:

- A: refers to the 1.2 Mb floppy drive.
- B: refers to the auxiliary floppy drive, either the second drive in a two-drive system or the single floppy drive in a hard-disk system.
- C: refers to the hard drive.
- < and > are used to identify the legends on specific keys that the user will be required to press during the model run. Examples are: press <Enter>; press <C>.
- When the user must enter commands in the operating system mode (that is, while the computer is still under DOS control rather than running HOUSE), we will precede the required command with the system prompt symbols and we will show the exact punctuation, spacing, and capitalization required.

#### **Backing Up the Model**

Before using any software program, it is wise to make a back-up copy of the software. That way, if electronic or physical damage should occur to the diskettes, the user can recover.

*For users with a hard drive.* After starting your PC, format three blank diskettes. (See your equipment user's manual for those procedures.) Place the

HOUSE Disk 2 into your B: drive. We will now copy the model to the hard disk. At the C> prompt, type:

```
C>md house <Enter>
```

```
C>cd house <Enter>
```

You have just created a subdirectory called HOUSE and moved into it. Now,

```
C\HOUSE>copy b:*. * <Enter>
```

Label one of your formatted floppy diskettes "HOUSE DISK 2 RUNTIME MASTER". Place it in the B: drive, and type:

```
C\HOUSE>copy *. * b: <Enter>
```

The computer will list the files as it copies them. Now place HOUSE Disk 1 into the B: drive and again type

```
C\HOUSE>copy b:*. * <Enter>
```

Label the next formatted floppy diskette "HOUSE DISK 1 MODEL MASTER". Place it in the B: drive and type

```
C\HOUSE>copy house.* b: <Enter>
```

```
C\HOUSE>copy bhouse.* b: <Enter>
```

Finally, label the last formatted floppy diskette "HOUSE SCENARIO DISKETTE", and leave space on it to write in the name of a scenario. Place the diskette in the B: drive and again, type

```
C\HOUSE>copy house.* b: <Enter>
```

```
C\HOUSE>copy bhouse.* b: <Enter>
```

You can repeat this last step as often as you want to create scenario diskettes.

*For users with 1.2 Mb floppy diskettes.* After starting your PC, format one blank data diskette and one blank system diskette. (See your equipment user's manual for those procedures.) Immediately, before forgetting which diskette is which, label the system diskette "HOUSE SCENARIO DISKETTE"; leave space on the label to write in the name of the scenario. Label the data diskette, "HOUSE MODEL MASTER".

Place this model master diskette into your A: drive (the high-density drive). Place the HOUSE Disk 1 into your B: drive (the low-density drive). We will now copy the model to the high-density disk. At the A> prompt, type:

```
A>copy b:*. * <Enter>
```

The computer will list the files as it copies them. Now place HOUSE Disk 2 into the B: drive and again type

```
A>copy b:*. * <Enter>
```

Take out the model master diskette, put a write-protect tab on it, and store it safely.

You now have the contents of both Disk 1 and Disk 2 on a single high-density system-formatted floppy. Now repeat the process using your scenario diskette in the A: drive. Repeat the scenario diskettes as often as you want. Remember that the scenario diskettes must be on system-formatted diskettes in order to work.

### **Preparing to Run HOUSE**

HOUSE requires considerable data about the project location. As delivered, it contains data about the Big Bend National Park in Southwest Texas. Those data are probably inaccurate for your project. Read the main report, to which this user's manual is appended, to understand the data requirements. Data input preparation sheets are included at the end of this user's manual (see Tables A-1 through A-3). Make copies, then use the sheets to make sure you have all the data you need!

When you are ready to run HOUSE, start your computer as before.

*Hard disk users:* At the C> prompt, place a HOUSE SCENARIO DISK in the B: drive. Then type

```
C>cd house <Enter>
```

```
C\HOUSE>house <Enter>
```

*1.2 Mb and drive users:* At the A> prompt, place a HOUSE SCENARIO DISK in the A: drive and type

```
A>house <Enter>
```

## 4. RUNNING THE MODEL

### Screen Appearance

HOUSE is similar to a normal Lotus 1-2-3 spreadsheet except that you cannot see the formulae, and you can only put data into those cells that are highlighted.

When HOUSE is first loaded, the screen credits appear. In the top-right corner of the screen, a "WAIT" or "X" will flash for 6 to 8 seconds while the data load into the program and the initial calculation is made. (Note: throughout this user's manual, times will be based on our experience on our equipment. Your PC may be somewhat slower, particularly if you are using an older model.) Do not select from the menu at this point if you are a first-time user: this manual will guide you through all the choices. Users with experience with HOUSE will be able to begin using the model at this point.

### Action Menus

As in Lotus 1-2-3, the main menu bar is at the top of the screen. When the menu is on the screen, your cursor, a highlighted rectangle, is somewhere on the menu bar. You can move it around with your left and right arrow keys. As the cursor rests on each of the menu choices, the next line on the screen displays a fuller explanation of what that choice does. You select an item by placing the cursor on it and pressing <Enter>.

The menus will be somewhat different from those found on a Lotus spreadsheet, but they work the same way. If at any time you are working in the model and the menu bar is not on the screen, press <Alt> and <M> simultaneously to restore the main menu bar.

Your cursor is presently on the "Assumptions" choice, and its explanation is displayed. The full set of choices, and the explanation of each, is:

- *Assumptions:* View the assumptions for the worksheet
- *Summary:* View the project summary
- *Recalc:* Recalculate the worksheet after changes
- *Work:* Escape the menus; this allows you to move around the worksheet

- *Print*: Print the summary of the scenario
- *Disk*: Save the scenario to disk.

We will discuss each of these choices in turn, as they would arise in a normal processing session.

## 5. ASSUMPTIONS

Press <Enter>. That selects the choice your cursor rests on; in this case, "Assumptions".

Your menu bar is replaced by another that offers the choices of:

- First page
- Second page
- Options
- Industry standards
- Government costs
- Building
- Main menu.

Again, we will discuss each choice in turn. To select "First page",

Press <Enter>.

### First Page

The first of two screens of assumptions (input data) is presented. This screen generally describes the parameters of the construction project and the conditions under which it will be executed. If you need to make changes to the data in this screen,

Press <Esc>.

The cursor will move out of the command line area into the top-left corner of the main data rectangle. The blocks formed by the rows and columns are referred to as "cells." The address of the cell in which the cursor now rests can be determined from



the lettered columns and numbered rows indicated at the edges of the spreadsheet area, in this case X1.

The only cells you can change are the highlighted ones. The way in which highlighting is displayed differs with each computer model: In color computers, protected cells are often displayed in white while unprotected (changeable) cells are green. In monochrome computers, the highlighted cells are displayed with a different intensity although from model to model the "highlighted" cells may be either brighter or dimmer than the normal intensity. Cell X3, the total number of units, is protected: that is, the normal color of a protected cell. Cell X4, the project location, is unprotected. Cells that appear on your screen with the color or intensity of X4 are the cells you can change.

Move the cursor to the cell you need to change with the arrow keys on the number pad section of the keyboard. Do not use the Tab key, which also has arrows on it, by mistake. If you get lost on the spreadsheet, simply press <Alt> and <M> to bring the menu back and select the assumptions page you were on. For those not familiar with Lotus 1-2-3, the procedures for making changes within a cell are described in Section 6 of this user's manual.

Some explanations about page 1 data may be needed. The following descriptions are intended as memory aids: More precise definitions are contained in the main text of this report.

- The start year (Y6) is the year that the construction contract is expected to be competed and awarded.
- The number of units to be removed (Y7) represents the removal requirement and is unrelated to the number of units to be rebuilt. These are covered by items Y8 and Y9 for which replacement units are built on the existing foundations (thereby saving money). New units require new foundations and site work.
- The capital replacement rate (Y11) is the level of capital escrow that the property management contractor must deposit annually in accordance with the Request for Proposals (RFP).
- The capital cost (Y15) is the current commercial loan rate.
- The Davis-Bacon rate (Y18) is the estimated savings on the labor component of construction projects if free-market labor were used instead of paying Department of Labor (union) wage rates.

- The occupancy figures (AB6 through AC9) are those projected for the housing after completion, not for the current configuration. Because HOUSE builds structures, while occupancy is based on housing units, of which there may be more than 1 per structure, the number of units will exceed the number of buildings. The new units are those in newly built structures, while the existing units are those in structures on the property today.
- The number of units to be rented to the public are assumed to be single-family units. The number to be rented on park property is at the National Park Service (NPS) discretion. The number built for private rental off the park must be determined from the land area available and the market demand.
- The total number of maintenance offices are those required by the RFP. For example, in the case of Big Bend, options were proposed which would have required the contractor to provide housing on the park and off the park, and at smaller parks nearby. That might have required up to five management offices for the contractor to staff, three on park property, and two on private land.

When all changes have been made, restore the main menu and select the "Second Page" choice.

## Second Page

The procedures for changing the data on this page are the same as those for the First Page. Press <Esc> to get onto the spreadsheet work area, then use the arrow keys to move to data that need changing.

The data items that may need explanation are:

- Location factors (E11 and E12) are industry-accepted adjustments to national average costs based on the project location.
- The distance to the baseline town (C15) is the one-way mileage.
- The unit square foot sizes (K1 and K2) are the requirements that would be imposed by the RFP. Two numbers are provided here in case off-park standards differ. Communities may expect either larger or smaller floor plans than those required by the Government.
- The land cost per unit (K3) may not be readily available, as most people think of land cost in terms of cost per acre. You cannot change the land cost per acre, so if the cost per unit is unknown, try different values until the cost per acre comes out right. Notice that the land cost per acre will not change

when you put in a new cost per unit, until you press <F9> to cause the model to recalculate.

- Appliances (K11) include all those items not considered part of the normal construction package. Ordinarily, ranges, refrigerators, and basic interior paint, carpet, and cabinetry are included in the normal construction cost, so this data item really accounts for items such as improved interior decorating packages, air conditioning, freezers, washers, and dryers, etc.
- The HQ/gate distance (K20) accounts for the distance from the average employee workplace to a potential off-site housing area, for use in calculating bus costs.

Again, once all necessary changes have been made, press <Alt> and <M> to restore the main menu, and select "Assumptions".

## Options

The "Options" choice denotes actions the Government can take to change its annual lease cost. Notice that this does not in any way change the actual cost of the project. Most of these actions result in an up-front expense to the Government; in the case of the utility payments and the provision of a bus, funds are diverted to or from the employees.

Ordinarily, all the data items on the Options Page should be set to zero. That most closely represents the probable situation. These data items are referred to as switches because they have only two values: 0 and 1. Zero means that the answer to the switch statement is "No". For instance, "Government has to borrow - 0" means there is no borrowing cost for the Government. Using "1" would mean that the Government would have to borrow to get the upfront capital. The switches were developed to permit easy "what-if" analyses without leaving the summary screen. The main text of the report describes these options in more detail.

Again, making changes in the switches requires you to press <Esc> to get into the work area, then use the arrow keys to move the cursor to the switch you wish to change. When you have finished, press <Alt> and <M> to restore the menu. If you wish to see the results of your changes while you are still on the summary screen, press <F9> (the <F9> key, not <F> and <9>) to make the model recalculate. Refer to the main text for an interpretation of the summary screen.

## Industry Standards

With the main menu restored, select "Assumptions", and then select "Industry Standards". Press <Esc> to get into the work area. Press the right arrow key to move across to the end of the data table: you will discover that in addition to the labels on the left, it is seven columns wide, not able to fit onto the screen all at once (see Table A-2).

The operating costs for modular housing should be identical to the costs used for single family housing. Generally, the costs for single family housing, unless you can obtain local estimates, should be similar to those for townhouses (the Institute of Real Estate Management [IREM] refers to these as garden apartments). This is also true for manufactured housing. Obviously, accurate local data from local managers is preferable, but in the absence of that data, the above approximations are acceptable.

Users do not have access to the last seven data categories beginning with unit density. An industry standard has been used; you adjust it with the location cost factors for labor and materials on "Assumptions" page two.

If the operating and construction data change, make sure that the year of the source material is changed at the top of the screen. Otherwise, HOUSE will continue to apply inflation estimates to the year stated on the screen to bring the costs up to the project start year.

Once you have made the necessary updates, again press <Alt> and <M> to restore the menu and choose "Assumptions".

## Government Costs

Choose "Govt Costs". Press <Esc> to get the cursor into the work area and use the arrows to move to any data elements that need to be changed.

When HOUSE was created, National Park Service (NPS) maintenance data were inadequate to create a good estimate of all in-house maintenance costs. We therefore used data from a military base as a proxy for the tax-equivalent costs (see Table A-3). The definitions of each of the categories are explained in Appendix B of the report. With the exception of utility costs, HOUSE rolls these data into a gross operating cost figure, so proper assignment of expenses to cost elements is not essential as long as all expenses are counted, and as long as utility costs are not

assigned to other cost elements. If changes to this data are required, the data year should also be adjusted.

Once you have made changes, press <Alt> and <M> to restore the main menu, and choose "Assumptions". We have not used the "Building" choice which will be described in Section 7. (The "Building" choice performs background calculations and is not apparent to the user.) Before we select the "Main Menu" choice, we will discuss how to actually make the changes within the cells. Those users familiar with Lotus 1-2-3 should skip one page to Section 7, "Scenario Summary."

## **6. MAKING CHANGES WITHIN CELLS**

Press <Esc> to get out of the menu bar, and move your cursor with the arrow keys to the cell you wish to change. Unlike the menu bar process, you do not have to press <Enter> to choose a cell in the work area. At the top-left corner of the computer screen (not just the worksheet area), you will see the cell address and the contents as shown on the screen in the work area. As you move the cursor around, you will notice the information changing as the cursor passes over each cell. Directly below that, still in the top-left corner, the cell address is repeated, this time followed by a blank. **Before trying to type in new data, read the following two paragraphs!**

Within each cell, HOUSE expects either a number or a word. The user can tell what is needed by looking at what is already present, since all data cells have been filled in the distributed version of the program.

Where words are expected, punctuation and numbers are acceptable because HOUSE simply stores information there for your visual reference. Number cells, however, require that you enter only numeric digits and decimal points: no dollar signs, no commas. Where dollar signs and commas are displayed, HOUSE has placed them there as part of the cell's format. Thus, in a cell which displays "\$12,023.46", you must enter <12023.46>. If you make a mistake and enter data that HOUSE cannot accept, your computer will beep. That will also happen if you try to enter data into a cell you are not allowed to access.

Now that you know what should go into the cell you want to change, type the correct entry on the keyboard while your cursor is on it. Notice that nothing happens in the cell on the screen. Your typing is being recorded in the formerly blank space at

the top-left corner of the computer screen. If it were not done that way, and you made a typing mistake, you would lose your old data and the new information would also be wrong.

So, if you make a mistake in the item you are typing, and you catch it, use the backspacing arrow (<Backspace>) key to correct your mistake. When you have entered correctly the information you think should be in the cell, press <Enter>. If you have provided an acceptable entry, it will be displayed in the cell. If, on inspection, you determine that you made a mistake, just leave your cursor on the cell and enter the information again.

Now that you can enter data, press <Alt> and <M> to get the main menu back and press "Assumptions".

## 7. SCENARIO SUMMARY

Now select the "Main Menu" choice. This simply gets you back to the main menu we have seen before. We have completed a review of the "Assumptions" choice. Now select the "Summary" choice. HOUSE jumps to the "Summary" screen. The interpretation of this screen is covered in Chapter 7 of the report.

The computer takes a few moments for the "wait" signal to clear because the model recalculates when you access the screen. This screen is the one you saw in adjusting the Government options. Those options, along with the type of building, were in fact designed to be adjusted from this screen so that it could be used for sensitivity testing. From this report screen you can take several actions.

When the screen is accessed, the menu bar has the choices of "Quit", "Building", or "Oops". "Quit" is used to save the scenario and return to DOS processing. "Oops" is used to return to the previous menu. By doing so, you can return to other assumption menus or the main menu.

The selection of "Building" brings up another menu bar, this one with the names of several types of buildings. The choices, and an explanation for each, are:

- *Doublewide*: A doublewide manufactured home, with a living area of approximately 1,300 + square feet
- *Modular*: Single family or townhouse homes built in factories

- *Elevator*: Apartment buildings four to seven stories high
- *Low-rise*: Two- to three-story apartment buildings (flats)
- *Townhouse*: Attached single family house
- *House*: Single family homes.

When a choice of a house type is made, HOUSE replaces all the housing-specific data in the calculations with the data for the selected house type. The model recalculates and the new results are displayed on the summary screen. You can invoke this option from any point in the model, but unless you are at the summary screen, you cannot really tell that anything happened.

If you decide that you selected "Building" by mistake, you can either choose the type of house already being used, in which case the model recalculates without changing anything, or you can use the <Esc> key to get rid of the menu bar.

Another change that can be made from the summary screen is the setting of the Government option switches, as described earlier. Make sure to press <F9> to make the model recalculate.

The advantage of providing these capabilities from the summary screen is to allow you to perform some fairly detailed sensitivity analyses on the alternatives without leaving the summary screen. This makes it easier to see what has changed as a result of your experimentation.

## 8. PRINTING THE RESULTS

A command we have not discussed yet is the "Print" command. Before selecting "Print" from the main menu bar, ensure your printer is connected and on-line. If you do not do so, your computer may lock up and you will not be able to save the data that you have entered in the current computing session.

Choosing "Print" from the summary screen requires that you clear the menu bars in one of two ways:

- Step backward from "Oops" to "Main Menu", or
- From the <Esc> mode with no menu bar, press <Alt> and <M>.

Then choose "Print" and the current summary screen will be sent to your printer. In addition, the printout will show the values of all your input data elements.

## **SAVING THE RESULTS**

The final command is the "Disk" command. The current HOUSE scenario always saves to the B: drive. Ensure you have a fresh HOUSE SCENARIO DISKETTE in the B: drive. DO NOT try to use a diskette that has a scenario on it already in an effort to save disk space. HOUSE scenarios are all stored under the same name: BHOUSE.WK1 and HOUSE.WK1. Thus, when saving a file, you overwrite any other file with the same name on that diskette.

From the main menu, select "Save". HOUSE will save itself onto the B: drive. This may take 3 to 5 minutes. If the computer beeps several times and appears to be taking an inordinately long time, type <Esc>. Then type </> <F><S>. You will see "name of file to save: B HOUSE"; press <Enter>. You will see "replace/cancel?"; press <R>. Again, the file will save itself. Once it has been saved, HOUSE will return to the model. That allows you to continue with data input and save several versions of the same project for comparison.

## **LEAVING HOUSE**

When you have finished with HOUSE, you must reboot the computer to get back to DOS. This manual requires a reboot because if you "Quit" without saving, all your work is lost. Therefore, to reduce the possibility of this occurring by accident, we force you to deliberately reboot your computer in order to exit without saving.



TABLE A-1

## ASSUMPTIONS ENTERED INTO MODEL

Data item	Your data	Default
Minor construction		\$4,263
Backlog		\$716,688
Location factor		
Labor		0.673
Materials		0.996
Land cost/unit		\$25
Town (Alpine, TX)		
Distance		108
HQ-gate (mile)		25
Children/unit		0.75
Impact aid		\$0
Season length		12
Occupancy		
Permanent family		15
Season family		20
Permanent single		16
Season single		20
Project concept		
Start year		1991
Remove		39
Replace		0
Build new		48
Renovate		45
Capital replacement		5%

  

Data item	Your data	Default
Infrastructure		\$250,000
Utilities		\$55,000
Potential secondary income unit-end-month		
on park:		\$50
off park:		\$100
Commercial lease		\$7
Square foot – Government		1,120
Square foot – local		1,120
Appliances		\$4,000
Administrative square foot		7,000
Private rentals		
on park:		1
off park:		0
Average employee salary		\$21,000
Current average		\$196
Inflation		4%
Discount		9%
Capital		11%
Lease period		40
Loan period		30
Davis-Bacon		15%
DSC overhead		46%

TABLE A-2

## DATA PREPARATION SHEETS - INDUSTRY COSTS

YEAR OF DATA: HOUSE 1988 YOUR DATA

	Waco, TX	Your data	Realtors - Odessa, TX	Your data	IREM - El Paso, TX	Your data	IREM - El Paso, TX	Your data	Realtors - Odessa, TX	Your data	Realtors - Odessa, TX	Your data
Construction type	Manu- facture		Modular		Elevator				Townhouse		Single family	
Market rent	\$3.40		\$3.90		\$2.50		Low rise 24 +		\$4.14		\$5.50	
Management	0.10		0.14		0.14		0.21		0.14		0.14	
Administrative staff	0.01		0.22		0.22		0.33		0.22		0.22	
Supplies	0.03		0.03		0.03		0.02		0.03		0.03	
Utilities	N/A		N/A		N/A		N/A		N/A		N/A	
Heating Fuel	0.01		0.01		0.01		0.09		0.01		0.01	
Electric	0.15		0.15		0.15		0.11		0.15		0.56	
Water	0.34		0.34		0.34		0.12		0.34		0.38	
Gas	0.08		0.08		0.08		0.08		0.08		0.56	
Sewer	0.00		0.00		0.00		0.00		0.00		0.00	
Building services	0.06		0.06		0.06		0.02		0.06		0.06	
Other operations	0.09		0.09		0.09		0.15		0.09		0.09	
Security	0.01		0.01		0.01		0.03		0.01		0.01	
Grounds maintenance	0.17		0.17		0.17		0.13		0.17		0.17	
Maintenance	0.32		0.32		0.32		0.19		0.32		0.32	
Painting/decorating	0.29		0.29		0.29		0.13		0.29		0.29	
Property tax	0.37		0.37		0.37		0.46		0.37		0.37	
State/local	0.01		0.01		0.01		0.01		0.01		0.01	
Insurance	0.35		0.35		0.35		0.15		0.35		0.35	
Recreation/amenities	0.23		0.23		0.23		0.05		0.23		0.23	
Other payroll	0.28		0.41		0.41		0.19		0.41		0.41	

**TABLE A-3**  
**GOVERNMENT OPERATING AND MAINTENANCE COSTS**  
(Dollars per square foot per year)

Government operating and maintenance costs	Your data	Big Bend data
Year of data		1988
Management		0.19
Administrative staff		0.05
Supplies		0.75
Utilities		0.98
Heating fuel		0.00
Electric		0.30
Water		0.20
Gas		0.20
Sewer		0.29
Building services		0.00
Other operations		0.00
Security		0.00
Grounds maintenance		0.00
Maintenance		0.00
Painting/decorating		0.00
Property tax		0.00
State/local taxes		1.78 *
Insurance		0.00
Recreation		0.00
Other payroll		0.90
<b>Total</b>	N/A	5.65
<b>Less utilities</b>	N/A	4.67
<b>Per unit/year</b>	N/A	\$4,702.00
<b>Per unit/month</b>	N/A	\$392.00

**Note:** N/A – Not Applicable.

\* From Andrews Air Force Base.

**APPENDIX B**

**INPUT DATA ELEMENTS**



## INPUT DATA ELEMENTS

Housing Options for United States Employees (HOUSE) requires 52 items of information about each site to be evaluated which fall into four major categories:

- Housing project definition
- General environment
- Local environment
- Operating costs.

### HOUSING PROJECT DEFINITION

- *Location:* Sufficient to identify the project, e.g., Big Bend, TX.
- *Start year:* The year in which the lease is expected to be awarded.
- *Unit disposition (numbers):*
  - ▶ *Build new:* New units requiring new sites
  - ▶ *Replace:* New units making use of existing site work
  - ▶ *Remove:* Existing units requiring demolition or removal (the replacement units will use some of these sites)
  - ▶ *Renovate:* Major repairs to existing units to bring them up to acceptable standards.
- *Occupancy:* The number of each of the new units to be occupied by permanent and seasonal families and singles. HOUSE assumes, for rent calculation purposes, that the families will occupy normal rental units, permanent-status single employees will occupy apartments at one-half the full-unit rate, and seasonal single employees will occupy dormitories at \$4 per day.
- *Public rentals:* The number of units to be rented to the general public at market rates. The National Park Service (NPS) can specify the desired number of units on park property. Off the park, the number must be estimated from the land area available and the potential market demand for houses.

- *Season length:* The number of months per year that the park houses seasonal employees.
- *Housing offices:* The number of sites at which the contractor must maintain a full-time management and maintenance capability. This addresses the possibility of multiple parks in a single package, or of multiple offices in a single park such as for on- and off-park housing areas.
- *Nonhousing requirements:* The need, if any, for additional construction to support administrative, storage, recreation, or other facilities.
- *Capital replacement fund requirement:* The Government may elect to require that the contractor create a replacement fund to cover the repairs that will be needed in the later years of a long-term contract. If so, HOUSE assesses that as a cost that would be included in any lease. HOUSE also forces the Government to spend an equivalent amount on its own facilities or undergo a major renovation program.
- *Construction type:* The type of building to be considered. HOUSE provides basic data for six types of buildings: manufactured homes, modular homes, single-family homes, garden apartments (townhouses), low-rise multifamily dwellings (flats), and high-rise apartments. HOUSE's menu system allows the user to switch among the building types without restarting the evaluation program.

## GENERAL ENVIRONMENT

- *Inflation:* The expected average inflation in the future
- *Discount rate:* The Government 20-year Treasury rate.
- *Capital cost:* The average interest rate being charged for construction and takeout financing.
- *Loan period:* The expected length of the contractor's loan.
- *Lease period:* The longest period for which the Government is prepared to sign a lease agreement.
- *Davis-Bacon adjustment:* The expected increase in cost of construction projects due to adherence to Davis-Bacon wage rates.
- *Government (Denver Service Center) overhead rate:* The rate charged to capital projects to pay for Government planning, design, and supervision.

- *Children per unit:* The NPS-wide average number of children per employee. This figure is used to calculate School Impact Aid and is not necessary if the cost of that aid is to be ignored.
- *Appliances:* The expected cost of a full appliance suite using Government (General Services Administration) rates. HOUSE assumes that the cost to the contractor will not be significantly different from that rate.

## LOCAL ENVIRONMENT

- *Impact Aid Regular-A Rate:* The amount of the annual payment per child due for Regular-A impact aid to the local school district.
- *HQ to gate distance:* The distance in miles from the average job site to the nearest community outside the park in which privately managed employee housing would be practical.
- *Distance to town:* The distance to the nearest town for A-45 rent calculations.
- *Town:* The name of the A-45 baseline town.
- *Location factors:* The rate (established in major trade publications) for labor and materials in the park as compared to the national baseline.
- *Minor construction budget:* The funds authorized for a typical year for construction beyond the immediate repair capacity or funding of the Government's on-site maintenance crews.
- *Maintenance and repair backlog:* The cumulative backlog of maintenance items awaiting funding.
- *Square footage requirements:* The minimum acceptable square footage for housing constructed by the Government and by the private sector.
- *Land cost per unit:* The value of the land required prorated by the number of units. As it is often easier to find out the cost per acre, HOUSE provides a calculated cost per acre. That allows users to iterate the cost-per-unit entry until an acceptable cost per acre is found.
- *Infrastructure and utilities:* Estimates of the cost to provide infrastructure (roads, sidewalks, storm drains, etc.) and utilities to the building site. General construction estimates include only the cost to provide these services within the building site itself. Because Government housing areas are often far distant from established connections and improvements, their costs must be considered a budget extra.
- *Potential secondary income:* The potential income, per unit-month, that might be expected for each unit over the established rent in return for



user-fee amenities such as satellite antenna service, swimming or recreation facilities, vending machines, etc. This amount may be greater on private land if existing facilities on Government property must be duplicated or if additional services can be provided.

- *Number of units to be leased to private renters:* The number of housing units constructed in excess of Government requirements. Those units are leased by the contractor to private renters at market rates.
- *Commercial lease rates:* The expected per-square-foot income generated by those extra facilities (administrative, storage, etc.) called for in the Government requirements. That income is based on comparable local rates for such space.

## OPERATING COSTS

HOUSE maintains two sets of operating costs: those considered standard by industry, and those experienced by the Government for the same types of services.

For private-sector operating costs for multifamily structures, HOUSE uses data collected by the Institute of Real Estate Management (IREM). Private-sector costs of operating single-family buildings, whatever the construction type, are not well documented and were obtained by the Logistics Management Institute from several owners of small residential rental properties. Government costs of operating housing are more readily available through the Government budgeting and accounting systems, although in many cases these data too are open to interpretation and may suffer from under-reporting or cross-charging, especially of labor. HOUSE uses the actual data at the specific site, when available. In order to be consistent, HOUSE uses the same cost elements for both private-sector and Government operating costs: Where these are of limited compatibility, the categories are used at the discretion of the analyst, with the most important proviso being that labor and materials costs not be intermingled in a cost element.

- *Market rent:* This is the average receipt per square foot per year for rent only (secondary income is not included).
- *Management fee:* This includes the agency fee (profit) paid by building owners to management subcontractors.
- *Administrative staff payroll:* This includes not only the salaries of the personnel in the property management office, but also all leases or contracts for personnel or services directly involved in property management. It also

includes most overhead costs: advertising, legal, auditing, engineering, professional organizations, telephone, and office expenses and supplies.

- *Supplies:* The cost of all supplies not accounted for under painting and decorating, maintenance, or repairs.
- *Utilities:* IREM categories include heating fuel of all types (gas, coal, electricity, oil, etc.); where a fuel is used for lighting and other household use, IREM provides a prorating formula. Additionally, IREM accounts for electricity, water and sewer (as a single item), and gas. The precise breakout of the use of a fuel between heat and miscellaneous uses is not significant to HOUSE because all utility costs are lumped together. More important is IREM's practice of separating its reported consumption into "Common area only" and "Common area plus apartments." Since Government provision of utilities is expected to be all-or-nothing for a particular service (that is, either it will provide free electricity to tenants or it will not), HOUSE users should ensure the "Common area plus apartments" data are entered.
- *Building services:* This expense item covers expenses for services rendered (generally contracted) not otherwise covered under janitorial, painting and decorating, maintenance, and repair (examples might be television antenna repair, window washing, trash removal, etc.).
- *Other operating expense:* This is a last-resort category in which any costs may be placed if no other category is appropriate. Examples include damage to uninsured property or directional signs.
- *Security:* In-house or contracted security services, including salaries and equipment.
- *Grounds maintenance:* This includes the salaries and supplies involved in all forms of light outside maintenance (but not minor construction).
- *Maintenance:* This includes interior and exterior maintenance activities - contracts and supplies other than interior painting and decorating. It includes exterior painting. It does not include salaries, and it does not include capital improvements, although some forms of expensive "minor construction," as envisioned by the Government, would be included such as roof repair.
- *Painting and decorating:* This cost element includes the cost of all interior painting and decorating supplies, contracts, and salaries. It includes the replacement of carpets, drapes, and furnishings if that is done at the operating-budget rather than capital-improvement level.
- *Property taxes:* IREM collects these data under the label "Real estate taxes." We have found that a number of jurisdictions are providing new

supplements to pure real estate taxes, and use the term "property taxes" as a broader term.

- *State and local taxes:* IREM data do not include income taxes paid by the property owners. Our intent is to identify all the taxes which can be attributed directly to that project. If local and state taxes can be identified directly, they should be included. Federal taxes are so dependent on the full range of the owners' other activities they cannot be estimated to any degree, and our experience has been that the property records show a loss for tax purposes in many cases.
- *Insurance:* All policies for fire, theft, liability, bonds, etc., except for that insurance which is really part of the employee compensation packages (workmens' compensation, life insurance, etc.) on an annual premium basis.
- *Recreation and amenities:* The costs of salaries, contracts, and supplies in providing indoor and outdoor facilities beyond the strict residential units, such as pools, exercise facilities, meeting rooms, game rooms, etc. It includes replacement costs.
- *Other payroll:* This includes payroll for janitors, maids, receptionists, maintenance personnel, and in general all personnel not accounted for under office administration, security, grounds, and recreation. In-kind compensation, such as living space, should be assessed and included.

The Government tax and insurance lines are handled differently from those of the private sector. For the private sector, those costs are collected as an average of real experience based on a proportion of the rental income. Governments, however, pay no taxes, and tend to self-insure, so that there is no experience data. However, in looking at the services paid for by taxes, it is clear that most Government facilities enjoy similar services — security, fire protection, roads, etc. — and HOUSE assumes that a proportion of these costs will be allocated against the housing function at the site under consideration. HOUSE calculates the equivalent cost of self-insurance as prescribed in OMB Circular A-76: If the Government does in fact obtain true insurance, HOUSE would require a very minor programming adjustment to allow input data to override that calculation.

In addition to the costs, HOUSE has stored the IREM- or industry-reported rent levels for such properties. Those values can be replaced with the actual rents for comparable units in the project vicinity. IREM uses a rent-per-square-foot data system to avoid the issue of mixed residence sizes. HOUSE users should input a weighted average rent based on the composition of units in their proposed projects.

**APPENDIX C**

**STANDARD FACTORS**



## STANDARD FACTORS

Standard factors are provided in Housing Options for United States Employees (HOUSE) for routine calculations which do not depend on the specific location of the housing project.

- *Maintenance backlog ratio:* This ratio is calculated rather than being input. It is used to determine whether the Government's own maintenance program measures up to the standard prescribed for the private operator, and then to determine whether the Government will be required to perform major rehabilitation on its own units (cell AI85).
- *Renovation:* The cost to renovate housing units as a proportion of the cost to build new units (cell AI87).
- *Mileage rate:* The cost per mile allowed by Office of Management and Budget (OMB) Circular A-45 in determining isolation adjustments (cell AI90).
- *Unit densities:* Each of the building types is assigned an assumed density of construction in units per acre. That figure is used to display the cost of land per acre, rather than per unit. If the proposed housing project will include unusually low or high densities, the cost of land per unit will differ from the local market conditions and should seem anomalous when HOUSE calculates it. As long as the cost per unit is correctly portrayed, this is not a problem (cells K4 and K5).
- *Impact Aid for Regular-B children:* This value is calculated from the Regular-A impact aid fee for the district. The Regular-A fee is an input value, and the Regular-B fee is set at 9 percent of the Regular-A value (cell AI92).
- *Outhaul cost:* HOUSE assumes that the cost to remove any building from Federal property is the same as the cost to bring in a mobile home (line 45).
- *Construction overhead:* Based on Means<sup>1</sup> data, an acceptable rate of overhead of 9.1 percent is assigned (cell AI95).
- *Subcontract passthrough profits:* Means data is for the completed project, with all subcontractor costs included. While some passthroughs may occur,

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<sup>1</sup>R. S. Means Company, Inc. *Means Square Foot Costs 1988*. Kingston, Mass.: R. S. Means, 1988.

they are already included in the basic construction price. HOUSE therefore allows no extra cost for passthroughs (cell AI97).

- *Construction profit:* A 7 percent profit is assigned (cell AI99).
- *Plan and design costs:* Private sector - 5 percent (cell AI101). Government - 10 percent (cell AI102).
- *Contingency fund:* Each construction project contains a 3 percent pad for unforeseen expenses (cell AI103). Government-supervised projects contain an additional 1.5 percent, built into the estimating equations. The Government itself estimates a 10 percent contingency fee (cell AI104) (or appropriated-fund projects).
- *Supervision, inspection, and overhead:* This factor represents the construction quality control costs. This is estimated at 2 percent for the private sector, plus an additional 2 percent for projects on Government land. The Government rate is determined by subtracting the planning, design, and contingency rates (cells AI102 and AI104) from the value selected for Denver Service Center cost. In addition, a Government-supervision rate of 2 percent is included for the private-sector projects to represent the cost of documentation and acceptance inspections (cells AI105 and AI107).
- *Financing fees:* A loan origination fee of 3 percent is assumed for private-sector financing (cell AI109).
- *Amount financed:* HOUSE assumes that loans for 90 percent of the capital value can be obtained on the strength of the Government rent guarantee (cell AI111).
- *Depreciation:* HOUSE calculates a depreciation writeoff for private ventures using a 27-year useful life and a corporation in the 33 percent tax bracket (cells AI113 and AI114).
- *Additional required space operating expenses:* HOUSE assesses the cost of operating secondary activity (administration, storage, etc.) at \$2.50 per square foot based on input from property managers in West Texas (cell AI117).
- *Operating profit:* A 15 percent profit is assumed to be necessary for operations and maintenance contractors (cell AI119).
- *Employee bus service:* If the housing area is to be off the park, bus service will have to be available. This will require four round trips daily by bus (operating cost 95 cents per mile including capital amortization) and two bus drivers (assumed salary burdened with benefits and overhead of \$40,000 each) (cell AI121).

- *Minimum capital replacement:* Regardless of the fund required to be set up in the lease, if capital replacement is inadequate, renovations will be required. HOUSE assigns that level as 2 percent of the initial cost (cell AI123).
- *Dormitory rent:* The charge for dormitory space is assumed to be \$4.00 per day (cell AI125).
- *Site preparation and support:* The cost of preparing a building lot for the building, as a proportion of the direct construction cost. The model is initialized using 22 percent, a General Accounting Office-developed figure (cell AI127).
- *Development fees per unit:* The charge levied on new construction by state and local Governments. There are two values, one for projects on Government land and one for projects on private land (cells AI130 and AI131).
- *Real discount rates:* The discount rate specified in OMB Circular A-104 is the 20-year Treasury bill rate. That rate, however, already includes the effects of inflation, as does the advertised cost for the private sector to borrow money. Because HOUSE handles costs in project-year dollars, the effect of inflation on these discount rates must be removed to avoid double-counting inflation (cells AI134 and AI135).
- *Construction costs:* Construction costs for different building methods are displayed in the industry standards table (see Table C-1). They are not accessible to the user, so they are treated as standard factors. The unit density is the number of units generally found per acre of land. The labor and construction data show the dollar components of the total cost per square foot; in some cases the total cost is computed from known labor and construction costs while in other cases, these components are calculated as proportions of a known total cost. The freight cost is the expected cost of a 700-mile shipment for a factory-assembled house. The Davis-Bacon switch identifies whether Davis-Bacon minimum wage rates would apply to the specified type of housing.



**TABLE C-1**  
**STANDARD COST RATES**  
**BASE YEAR: 1988**

	Waco, TX	Realtors- Odessa, TX	IREM- El Paso, TX	IREM- El Paso, TX	Realtors- Odessa, TX	Realtors- Odessa, TX
Construction type	Manufacture	Modular	Elevator	Low rise	Townhouse	Single family
Unit density	6	6	50	25	15	6
Labor	\$2.00	\$7.79	\$22.88	\$26.78	\$21.25	\$22.75
Construction	\$12.00	\$14.46	\$44.41	\$32.74	\$23.02	\$24.65
Total construction	\$14.00	\$22.24	\$67.29	\$59.52	\$44.27	\$47.40
Labor/total	14%	35%	45%	45%	48%	48%
Freight cost	\$1,500	\$1,500	Incl in rate	Incl in rate	Incl in rate	In rate
Davis-Bacon	0	0	1	1	1	1

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